

# Risk Factors for Blood Loss in Aneurysmal Bone Cyst Surgery: What Matters?

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**INTRODUCTION:** Preoperative estimation of intraoperative blood loss is essential for its management, and literature is lacking with respect to factors influencing blood loss in aneurysmal bone cyst (ABC) surgery. With this study, we seek to identify risk factors and predictors for blood loss in ABC surgery.

**METHODS:** An IRB-approved retrospective review was performed from 2011-2021 at a pediatric tertiary care center. Using CPT codes, we identified pediatric patients (< 18 years old) undergoing surgical curettage and bone grafting for ABC excluding lesions present in the skull and ribs. Data collected included demographic data (age, sex), Enneking stage, Capanna type for limb lesions, lesion location, lesion volume (calculated as Transverse x Craniocaudal x Anteroposterior), and history of pathological fracture prior to surgical management. Blood loss was recorded as 1) absolute blood loss during surgery and 2) percentage loss of total blood volume for individual patients based on their weight and age. Blood loss reported as minimal was recorded as the value corresponding to the 25th percentile of all reported blood loss observed as 10 ml in this study. Statistical testing was performed using bivariate statistics (Mann-Whitney, Kruskal-Wallis) and linear regression.

**RESULTS:** We identified a total of 102 patients with a mean age of 11.53 years at the time of surgery (range 1.0 to 18.2). Demographics with mean blood volume, lesion size, absolute blood loss, percentage of blood loss, and patient population are reported in Table 1. Absolute blood loss significantly increased with age (p=0.003), while percentage blood loss did not (p=0.995). Absolute blood loss and the percentage increased significantly (p< 0.001 for both) with respect to lesion size. Risk factors for absolute and percentage blood loss were identified as Enneking types (type 3) and location (spine/pelvis) for all lesions (p < 0.05) while for lesions in the limbs, those located in the shoulder/hip (not amenable to tourniquet application) were identified as a risk factor for both absolute and percentage blood loss (Table 2). Linear regression identified lesion volume as a predictor (p< 0.001) for all lesions with respect to absolute blood loss only while shoulder and hip location was a significant predictor (p=0.002) for limb lesions with respect to both absolute and percentage blood loss.

**DISCUSSION AND CONCLUSION:** Surgical management of Aneurysmal Bone Cyst (ABC) is accompanied by bleeding. Increasing age, and lesion size increase blood loss after ABC surgery. Our study identified Enneking type 3, spinal/pelvic lesions, locations not amenable to tourniquet application like lesions of the shoulder or hip as risk factors for blood loss and should be considered prior to surgical management of ABC.

	N	n (%) / Mean (SD)
<b>Mean age (years)</b>	102	11.5 (4.2)
<b>Gender</b>	Male	48 (47.1)
	Female	54 (52.9)
<b>Location</b>	Upper Limb	31 (30.4)
	Lower Limb	53 (52.0)
	Spine	11 (10.8)
	Pelvis	7 (6.8)
<b>Enneking Type</b>	1	4 (3.9)
	2	67 (65.7)
	3	31 (30.4)
<b>Capanna Type (For limb Only)</b>	1	2 (2.1)
	2	52 (61.9)
	3	25 (29.8)
	4	4 (4.8)
	5	1 (1.2)
<b>Lesion Size (mm<sup>3</sup>)</b>	102	49.1 (61.4)
<b>Blood Volume (ml)</b>	102	3445.4 (1602.2)
<b>Absolute Blood Loss (ml)</b>	102	153.9 (290.5)
<b>Percentage Blood Loss (%)</b>	102	4.5 (9.0)

Factor	n	Absolute Blood Loss	p	Percentage Blood Loss	p
<b>Sex</b>			0.917		0.834
Male	48	180.7 ± 356.3		5.0 ± 11.0	
Female	54	194.9 ± 506.6		4.0 ± 6.8	
<b>Enneking Type</b>			<b>0.001</b>		<b>0.001</b>
1	4	32.5 ± 45.0		1.0 ± 1.6	
2	67	72.7 ± 147.5		2.1 ± 3.5	
3	31	345.1 ± 426.2		10.3 ± 14.1	
<b>Location</b>			<b>&lt;0.001</b>		<b>&lt;0.001</b>
Limb	84	59.7 ± 122.48		1.9 ± 3.2	
Spine/Pelvis	18	593.2 ± 424.1		16.9 ± 15.4	
<b>Pathological Fracture</b>			0.158		0.603
Yes	60	76.5 ± 122.7		2.6 ± 3.3	
No	42	208.5 ± 356.1		5.9 ± 11.3	
<b>Capanna Type</b>			0.360		0.059
1	2	6.0 ± 5.6		0.1 ± 0.1	
2	52	65.6 ± 145.2		2.1 ± 3.7	
3	25	61.3 ± 81.1		1.9 ± 2.4	
4/5	5	13.0 ± 4.4		0.3 ± 1.9	
<b>Region*</b>			<b>0.006</b>		<b>&lt;0.001</b>
Shoulder/Hip	25	115.5 ± 194.8		3.7 ± 4.8	
Other	59	36.1 ± 63.19		1.1 ± 1.9	

\*Classifies based on applicability of tourniquet